

Personal networking: a new approach to ubiquitous computing

Roy Want et al.

Pervasive
Computing 2001

Intel Research



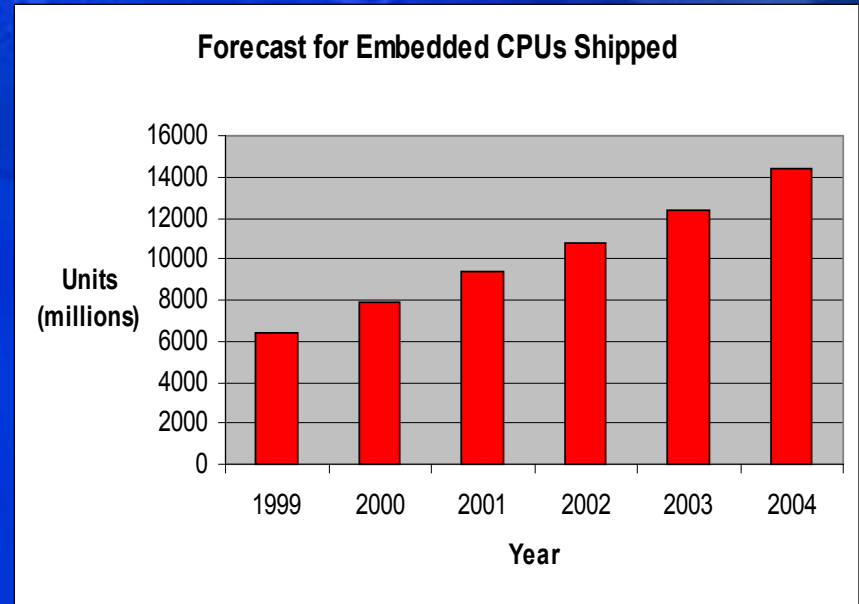
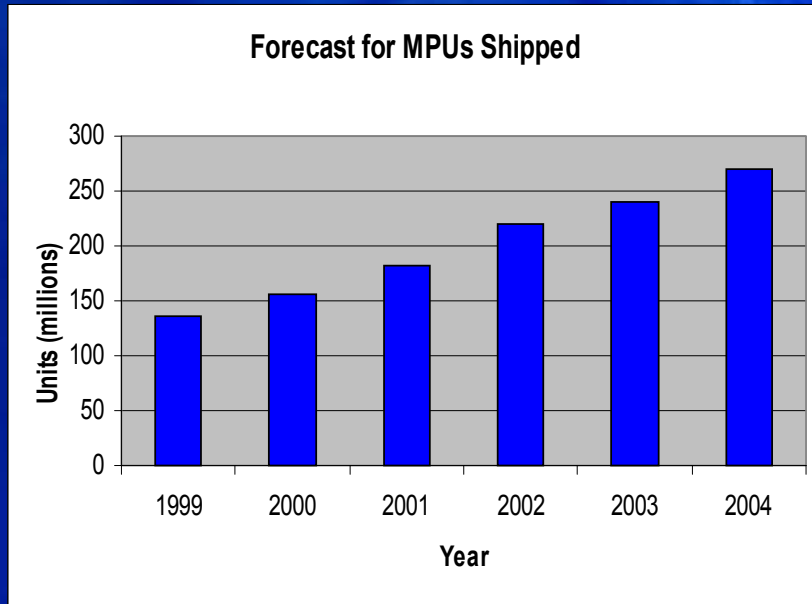
Opportunistic Times

- 150M PCs shipped in 2000
- 8 billion embedded processors shipped in 2000
- Lots of computational infrastructure all around us wherever we go.



- We have a ubiquitous infrastructure, but generally not Ubiquitous Computing

Forecasts for shipments of MPU and embedded CPU components



IDC – Gartner group 2001

Computer infrastructure will become even more ubiquitous

The Opportunity

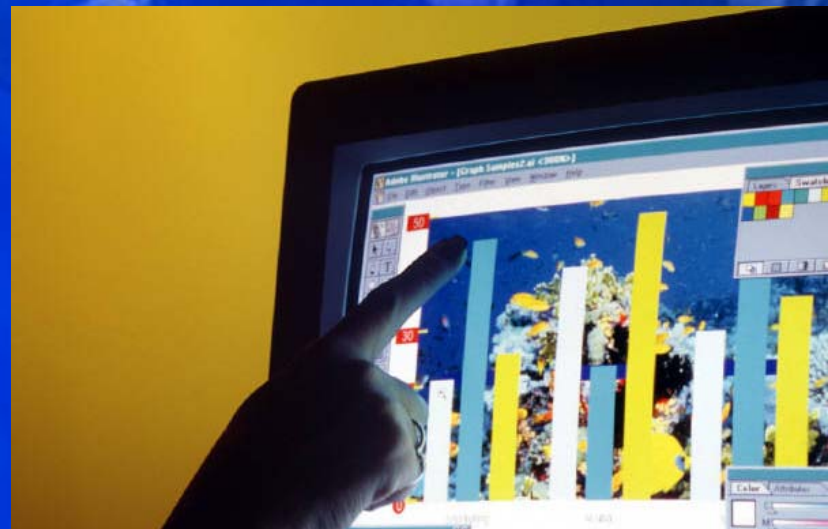
- Using the local computational infrastructure to interact with your own data and applications
- Overcoming the limitations of small-screen mobile devices
- Freeing people from lugging around heavy computing platforms
- Increasing the value of mobile computation for the user

Some Issues

- Integrating with legacy systems and foreign environments
- Utilizing local input, output, and computation resources
- Mutual trust & data security

One Solution: The Personal Server Concept

Personal
Server



A Personal Computer

but actually only one of many computers being used

THE PERSONAL SERVER PROVIDING UBIQUITOUS ACCESS THROUGH A UBIQUITOUS INFRASTRUCTURE



Office

Personal
Server



Home



Visiting Customers

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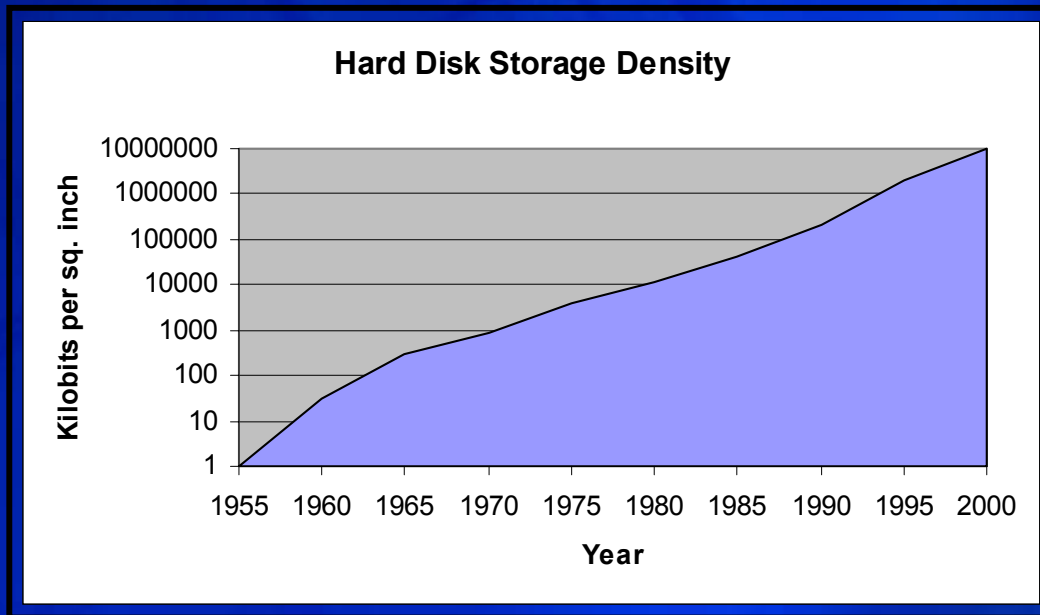
THE PERSONAL SERVER PROVIDING UBIQUITOUS ACCESS IN A MOBILE WORLD



Some Technology Trends

Disk storage density

- Storage density is doubling each year
- 10Gbits per sq.in is available now



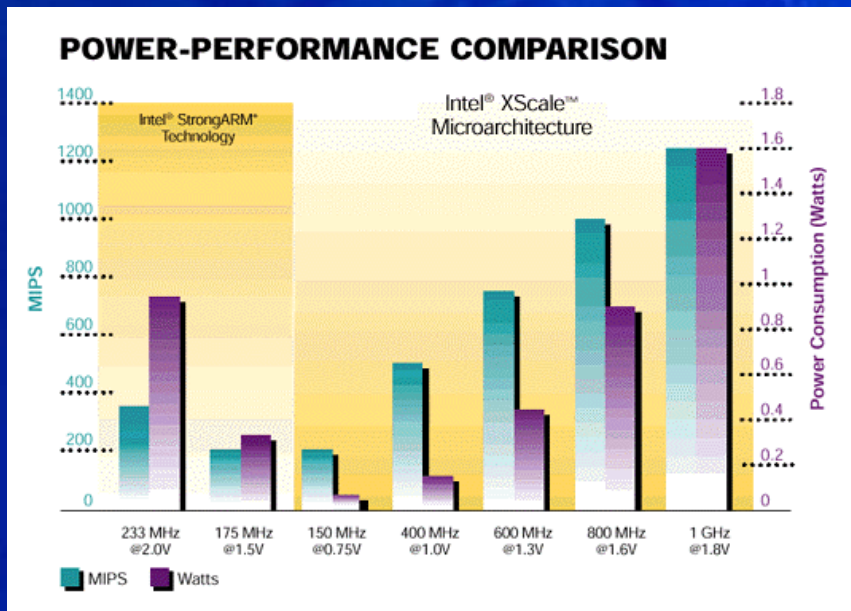
A 1GB disk drive in
a compact flash card format

Scientific American, May 2000

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Some Technology Trends

Processor Power/Function



■ Commercial RISC processors

- Power efficient
- Optimized clock speed and supply voltage

■ Intel® StrongARM™ to 350MHz

■ Intel® XScale™ to 1 GHz (DVM)

Some Technology Trends

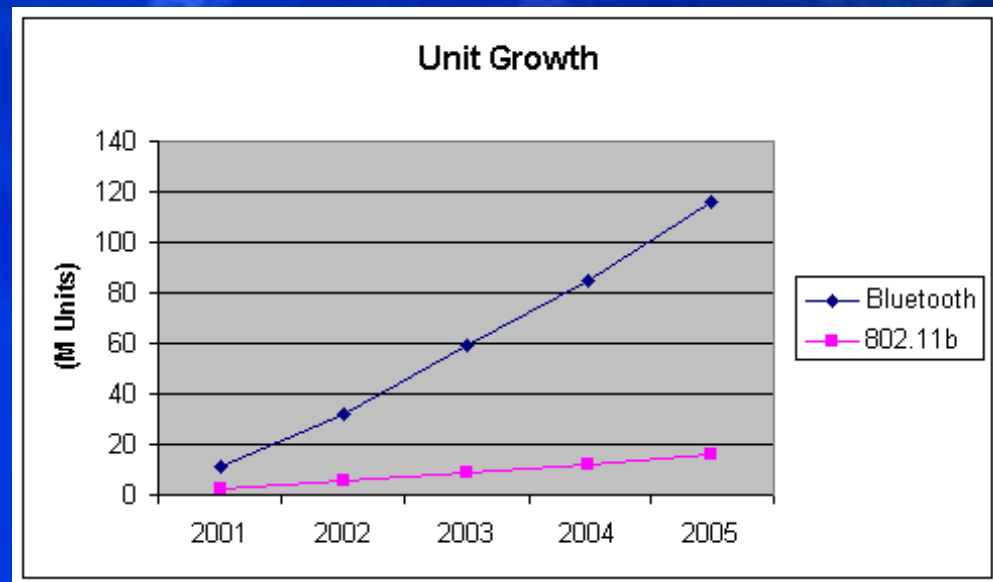
Short Range Wireless Links

■ Wireless communication technologies are becoming standardized

- Bluetooth* 1.2Mbps (symbol rate)
- IEEE 802.11b* 11Mbps (symbol rate)

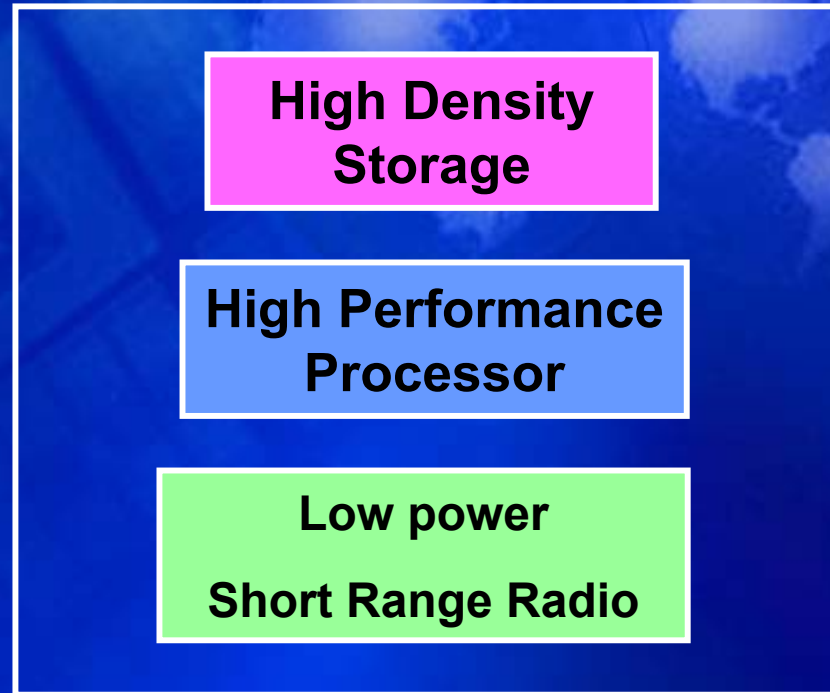
■ Bluetooth volumes are likely to be driven by GPRS and 3G cell phones

- Low power
- Physically small implementation



Bluetooth: Sullivan & Frost 2001
IEEE802.11: Gartner Group

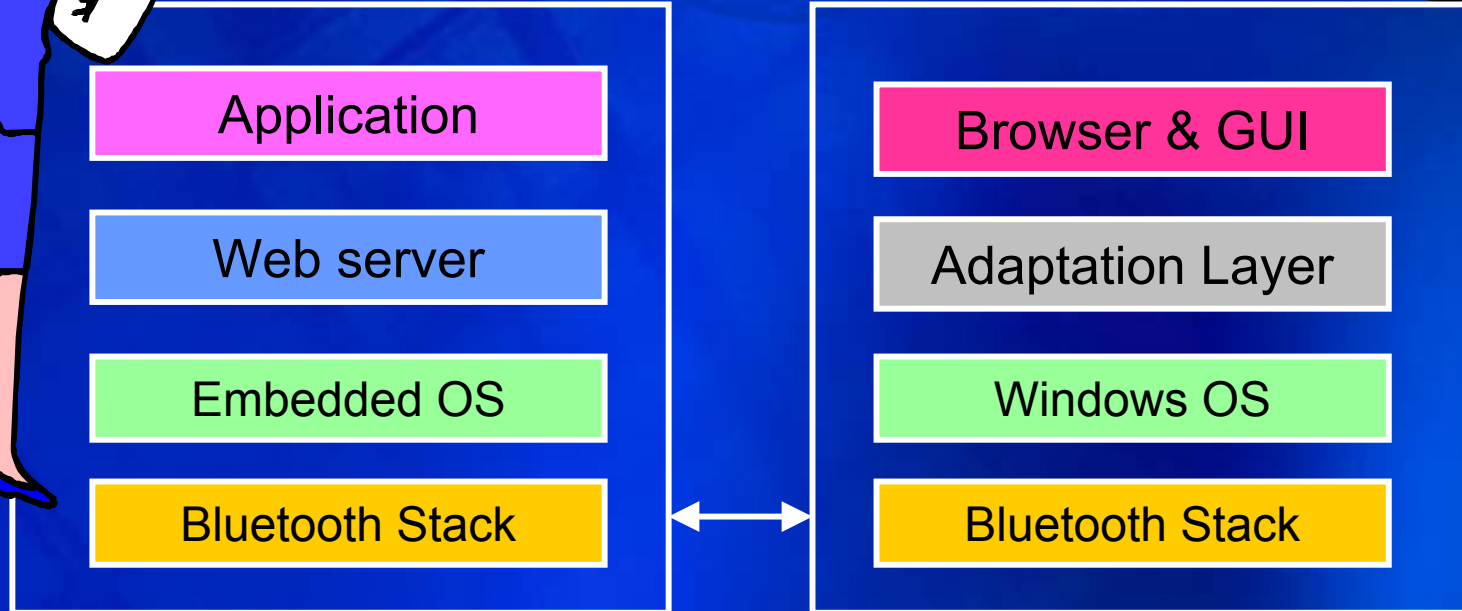
The Personal Server



Physically Small
Form Factor

- No display or keyboard
- The interface is only accessible via the wireless link

Software Infrastructure – first approach



- Adaptation layer enables use of legacy systems

Mobile Storage Application

■ Wireless Disk Drive

■ Working Data Set Cache

- Most recently used documents
- Work group documents
- Reference material

■ Lifetime data storage system

- Continuously collecting data, filtering and discarding



Personal Server

Virtual Devices

■ Emulation of common devices on the screen of a PC

- Your Palm*, Compaq iPac*, Cell Phone



■ New ways to interact with the data contained in portable devices

- Make full use of the screen
- Expand the scope of the operations you would expect to find on a portable

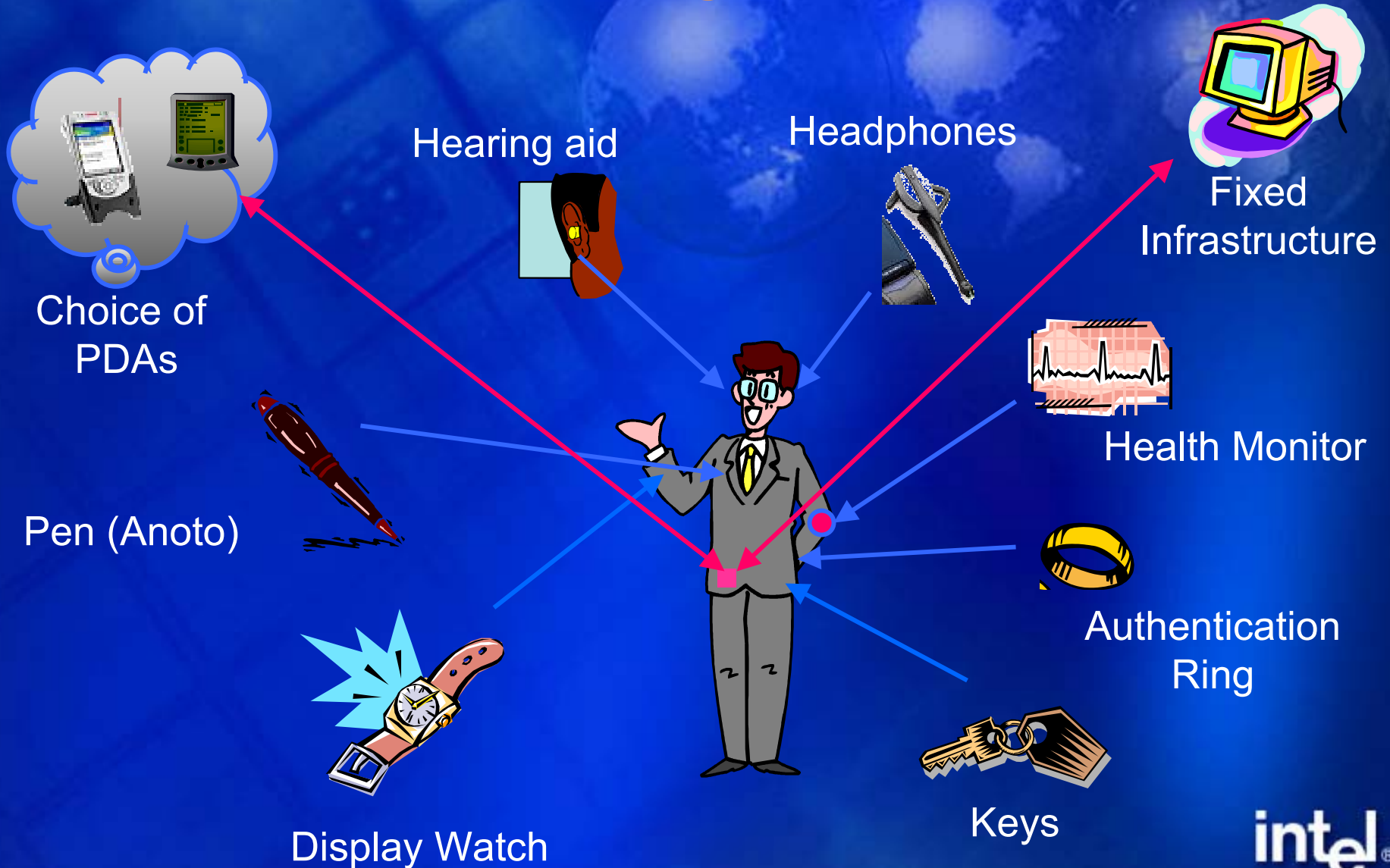
Challenges

- **Providing an excellent mobile user experience**
- **Integration with Legacy Systems**
- **Dynamic User Interfaces**
 - Device independent UI descriptions
 - Use of available machine resources (e.g. input peripherals)
- **Mobile Code**
 - Code migration from Personal Server to target resource to take advantage of superior computation engine
 - Reduce power consumption on mobile component
- **Building a Personal Server Platform**
 - Providing enough speed and connectivity to support personal computation
 - Optimizing the design for low-power, size, and weight
 - Acceptable battery lifetime

Not your average wearable computer



Personal Server: Supporting a Personal Computing Environment



Looking to the Future

■ We will be building an experimental system

- System Replication
- Integration with work practice
- Working with some universities

■ Fully explore security models

■ Building a demonstration environment

- Demonstrate a representative suite of applications using common infrastructure
- Explore new ways of designing applications to make best use of the personal server approach

Acknowledgements

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